OPERATING SUMMARY

WATERLOO

water pollution control plant

1968

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ONTARIO WATER RESOURCES COMMISSION

Division of Plant Operations

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Water management in Ontario

Ontario
Water Resources
Commission

135 St. Clair Ave. W.
Toronto 7
Ontario

We are pleased to present you with the Operating Summary for the water pollution control facilities operated for you during 1968.

Both the financial and technical information presented should be of assistance to your present and future planning in this important phase of municipal activity.

A new format has been devised to allow greater readability with equally detailed content. We trust that this will meet with your approval.

Our staff wish to express their appreciation for your co-operation throughout the year.

D Caverly
D. S. Caverly,
General Manager.

D McTavish
D. A. McTavish, P. Eng.,
Director,
Division of Plant Operations.

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WATERLOO

water pollution control plant

operated for

THE CITY OF WATERLOO

by the

ONTARIO WATER RESOURCES COMMISSION

1968 ANNUAL OPERATING SUMMARY

FOREWORD

● This operating summary outlines the project's technical capabilities and financial status in 1968. Such information mirrors past and present performance, but a major intention is to anticipate the future -- to solve problems before they occur.

The new format in which this year's data are presented is designed to offer a higher level of readability than in the past, without a corresponding decrease in compactness, accuracy and detail.

Although your Regional Operations Engineer carries the major responsibility for the contents of the report, those involved in its preparation are attached to several Commission sections and divisions. The statistics section of the Division of Plant Operations compiled the information for the graphs and charts. The draughting section of the Division of Sanitary Engineering drew the graphs. The Division of Finance provided all cost data.

Only the close co-operation of these departments allowed the publication of this summary.

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'68 REVIEW

An estimated total of 1533.7 million gallons of sewage was treated during the year at a total cost of $138,403.88. The cost per pound of BOD removed was three cents. Flow data were not obtained from June to November while the plant extension was being constructed.

The existing flow data show the average daily flow was 4.31 million gallons, a 12.5 percent increase over the 1967 average daily flow of 3.99 million gallons.

During the year, the plant reduced the BOD and suspended solids concentrations with average reductions of 91 percent and 85 percent respectively. The average effluent BOD and suspended solids concentrations were 28 mg/l and 37 mg/l.

Construction of the plant extension proceeded until the latter part of November, when the project was substantially completed. The extension consisted of the addition of one primary clarifier, two digesters, and degritters. Renovations were made to the administration building, aeration section and sludge pumping facilities.

Under the supervision of head office engineers, the plant staff operated a clean, attractive and efficient plant for the City of Waterloo.

It should be noted that project costs for the plant extension described above are not included in this report. A full breakdown will be presented in the 1969 annual operating summary.

PROJECT COSTS

STAGE 1

NET CAPITAL COST (Final) Long Term Debt to OWRC	$728,675.93

Debt Retirement Balance at Credit (Sinking Fund) December 31, 1968	$261,651.43

Net Operating	$138,403.88
Debt Retirement	26,436.00
Reserve	4,704.24
Interest Charged	40,910.32
TOTAL	$210,454.44

RESERVE ACCOUNT

Balance at January 1, 1968	$ 26,960.60
Deposited by Municipality	4,704.24
Interest Earned	1,688.87
	$ 33,353.71
Less Expenditures	228.51
Balance at December 31, 1968	$ 33,125.20

* **STAGE 2**

NET CAPITAL COST (Final) Long Term Debt to OWRC	$13,226.41
Debt Retirement Balance at Credit (Sinking Fund) December 31, 1968	$ 3,893.06
Net Operating	$ nil
Debt Retirement	552.00
Reserve	127.92
Interest Charged	742.58
TOTAL	$ 1,422.50

RESERVE ACCOUNT

Balance at January 1, 1968	$ 906.10
Deposited by Municipality	127.92
Interest Earned	56.48
	$ 1,090.50
Less Expenditures	-
Balance at December 31, 1968	$ 1,090.50

* Transformer bank

SPECIAL OPERATING AGREEMENT

NET CAPITAL COST Long Term Debt to OWRC	$ Nil
Debt Retirement Balance at Credit (Sinking Fund) December 31, 1968	$ Nil
Net Operating	$ Nil
Debt Retirement	Nil
Reserve	1,400.00
Interest Charged	Nil
TOTAL	$1,400.00

RESERVE ACCOUNT

Balance at January 1, 1968	$2,175.45
Deposited by Municipality	1,400.00
Interest Earned	162.67
	$3,738.12
Less Expenditures	-
Balance at December 31, 1968	$3,738.12

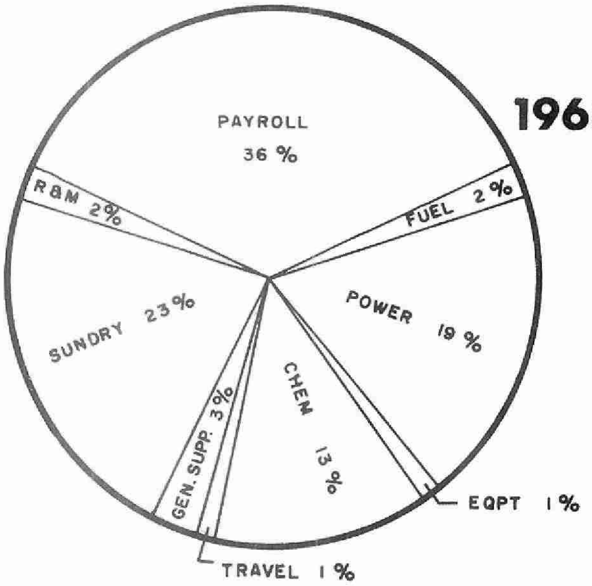
Monthly Operating Costs

MONTH	TOTAL EXPENDITURE	PAYROLL	CASUAL PAY ROLL	FUEL	POWER	CHEMICAL	GENERAL SUPPLIES	EQUIPMENT	REPAIRS & MAINTENANCE	* SUNDRY	WATER	TRAVEL
JAN	4513.94	3687.14	-	-	-	247.96	144.42	-	409.97	-	-	24.45
FEB	11158.43	3740.13	-	442.38	2572.47	1744.90	339.83	2.56	7.07	2107.67	-	191.42
MAR	13715.85	5813.01	-	342.66	2157.38	1859.48	322.03	43.52	196.94	2931.44	-	49.39
APRIL	11450.48	3735.28	-	124.98	2302.08	2508.63	268.25	-	232.26	2213.32	-	65.68
MAY	10668.20	3308.22	296.41	121.18	2064.20	1480.52	607.83	346.27	5.68	2394.49	-	43.40
JUNE	10042.19	3054.46	656.03	95.19	2043.80	3246.67	130.15	101.93	713.76	-	-	-
JULY	12715.60	3267.08	718.51	-	2369.82	-	261.20	22.90	77.61	5846.54	-	151.94
AUG	18089.41	5029.56	906.73	50.46	2601.13	500.32	152.53	400.55	270.74	8039.42	-	137.97
SEPT	9509.32	3485.37	195.78	238.57	1866.38	2715.87	348.10	62.10	520.52	30.10	-	46.53
OCT	9865.27	3039.35	263.79	-	1424.10	255.24	374.12	187.97	257.04	3994.50	-	69.16
NOV	8746.57	2901.23	253.26	-	2900.89	1269.09	167.50	-	18.11	1043.82	-	192.67
DEC	17928.62	6035.02	-	1218.06	3389.21	2124.50	392.06	268.22	705.29	3713.98	-	82.28
TOTAL	138403.88	47105.85	3290.51	2633.48	25691.46	17953.18	3508.02	1436.02	3415.19	32315.28	-	1054.89

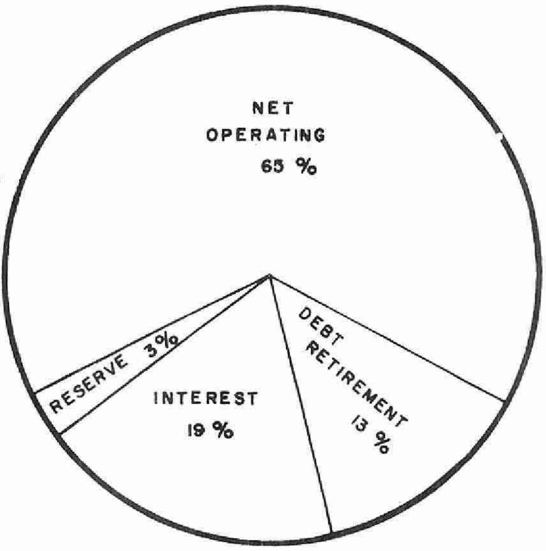
* SUNDRY INCLUDES SLUDGE HAULING COSTS WHICH WERE $25,848.90

BRACKETS INDICATE CREDIT

1968 OPERATING COSTS



TOTAL ANNUAL COST



Yearly Operating Costs

YEAR	M.G.TREATED	TOTAL COST	COST PER MILLION GALLONS	COST PER LB OF BOD REMOVED
1964	852.94	$112,364.00	$131.74	2 cents
1965	924.09	140,427.32	151.96	4 cents
1966	1139.85	120,343.71	105.58	4 cents
1967	1456.86	142,609.57	97.89	4 cents
1968	1533.7 *	138,403.88	90.24	3 cents

* Estimated on 183 days data

Process Data

The average daily flow for the year was 4.31 million gallons. However, it should be noted that data were obtained only from January to May inclusive, and for December. Flow data were not obtained for the remainder of the year because of the construction of the plant extension. The average daily flow in 1968 represents a 12.5 percent increase over the 3.99 mg recorded in 1967. The design daily flow of four million gallons was exceeded 60 percent of the time.

The raw sewage BOD averaged 303 mg/l. This is not a significant change from the 1967 average of 290 mg/l. The design raw sewage BOD concentration of 300 mg/l was exceeded 60 percent of the time as compared to 50 percent of the time in 1967.

The raw sewage suspended solids averaged 252 mg/l as compared to 284 mg/l in 1967. The design raw sewage suspended solids concentration of 270 mg/l was exceeded 43 percent of the time.

The average effluent BOD and suspended solids were 28 mg/l and 37 mg/l respectively. The plant effluent BOD and suspended solids concentrations exceeded the OWRC objective of 15 mg/l, 87 percent and 100 percent of the time respectively.

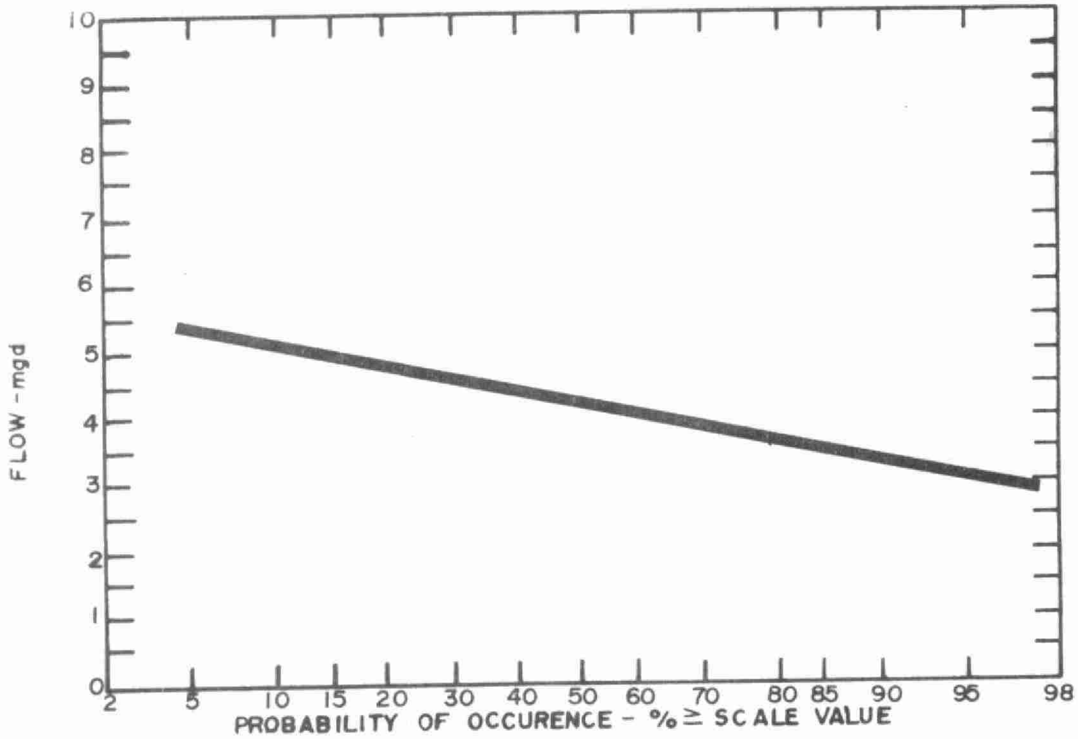
The average plant BOD and suspended solids reduction efficiencies were 91 percent and 85 percent.

PLANT FLOWS and CHLORINATION

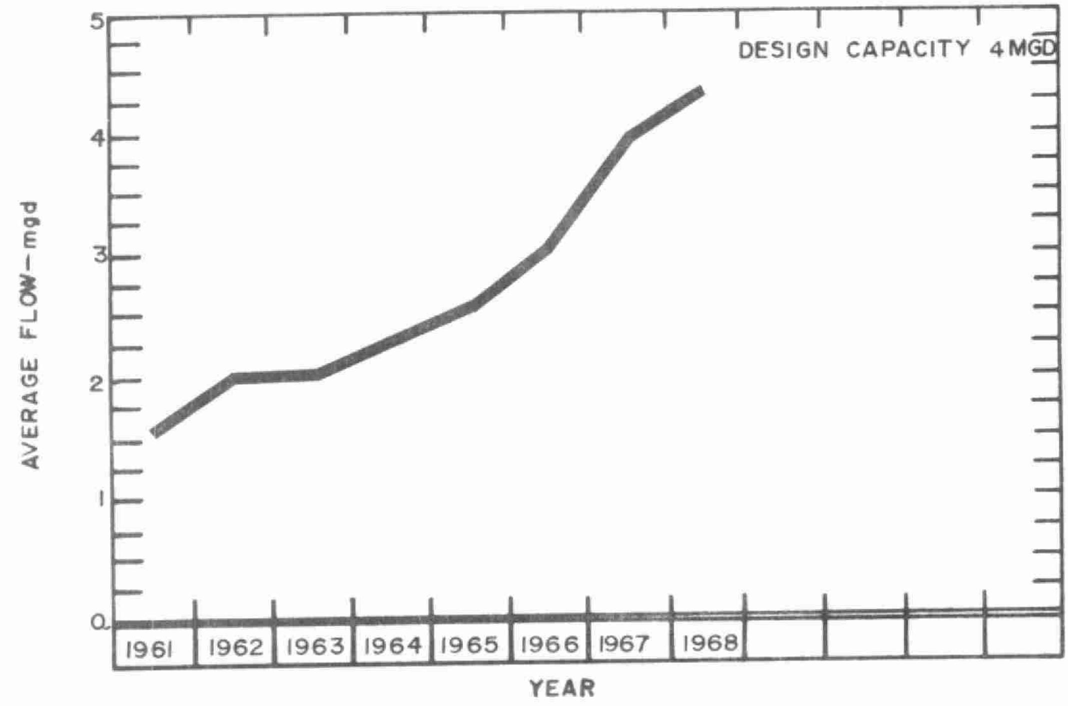
MONTH	TOTAL FLOW mg	AVERAGE DAILY FLOW mg	MAXIMUM DAILY FLOW mg	MINIMUM DAILY FLOW mg	CHLORINE USED 10^3 lbs.	DOSAGE mg/l
JAN	114.2	3.68	5.26	2.63	6.24	5.5
FEB	118.1	4.07	5.29	3.24	6.00	5.0
MAR	139.3	4.50	5.25	3.20	6.35	4.6
APR	125.2	4.17	5.31	2.69	6.14	4.9
MAY	117.6	3.79	4.35	3.18	6.30	5.4
JUN	–	–	–	–	4.62	–
JUL	–	–	–	–	6.62	–
AUG	–	–	–	–	7.92	–
SEPT	–	–	–	–	6.58	–
OCT	–	–	–	–	6.80	–
NOV	–	–	–	–	7.30	–
DEC	130.6	4.21	5.46	2.26	6.61	5.1
TOTAL	–	–	–	–	76.48	–
AVERAGE	–	4.31	–	–	6.37	5.1

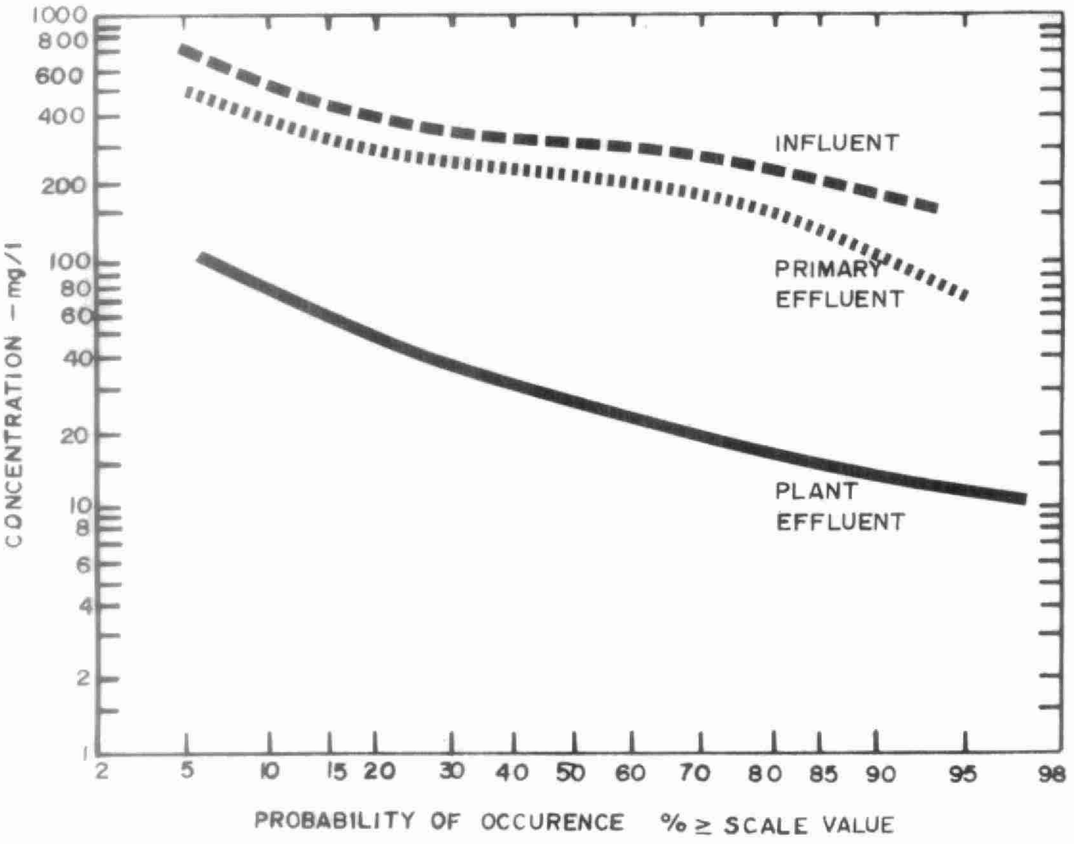
COMMENTS

From the data obtained, the average daily flow was 4.31. Flow data were not available from June to November while the plant extension was being constructed.

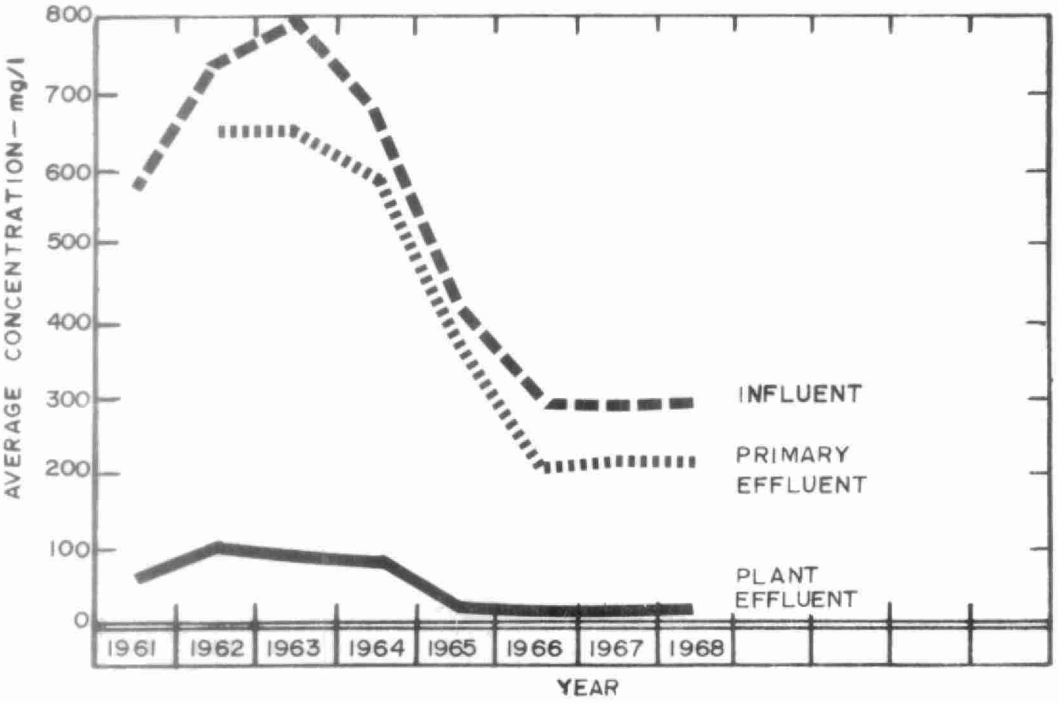

FLOW - mgd
0
1
2
3
4
5
6
7
8
9
10
2
5
10
15
20
30
40
50
60
70
80
85
90
95
98
PROBABILITY OF OCCURENCE - % ≥ SCALE VALUE

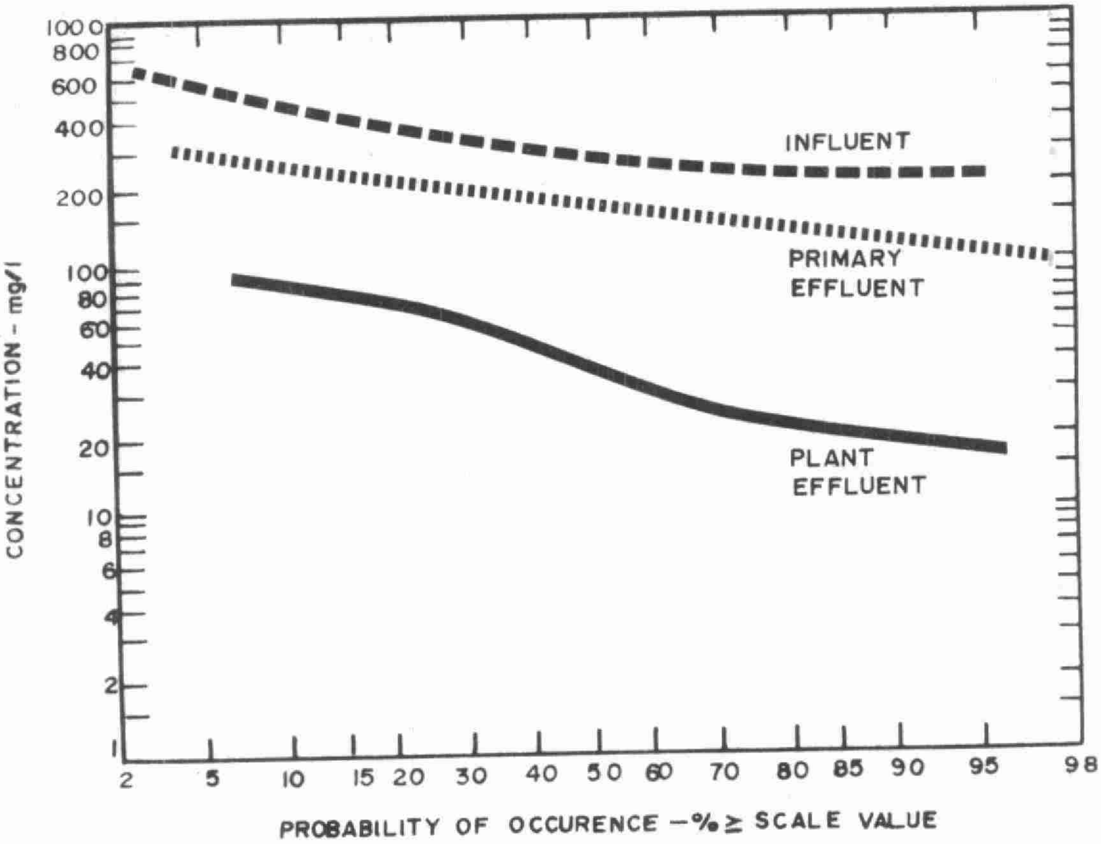
FLOWS


AVERAGE FLOW - mgd
0
1
2
3
4
5
DESIGN CAPACITY 4MGD
1961
1962
1963
1964
1965
1966
1967
1968
YEAR

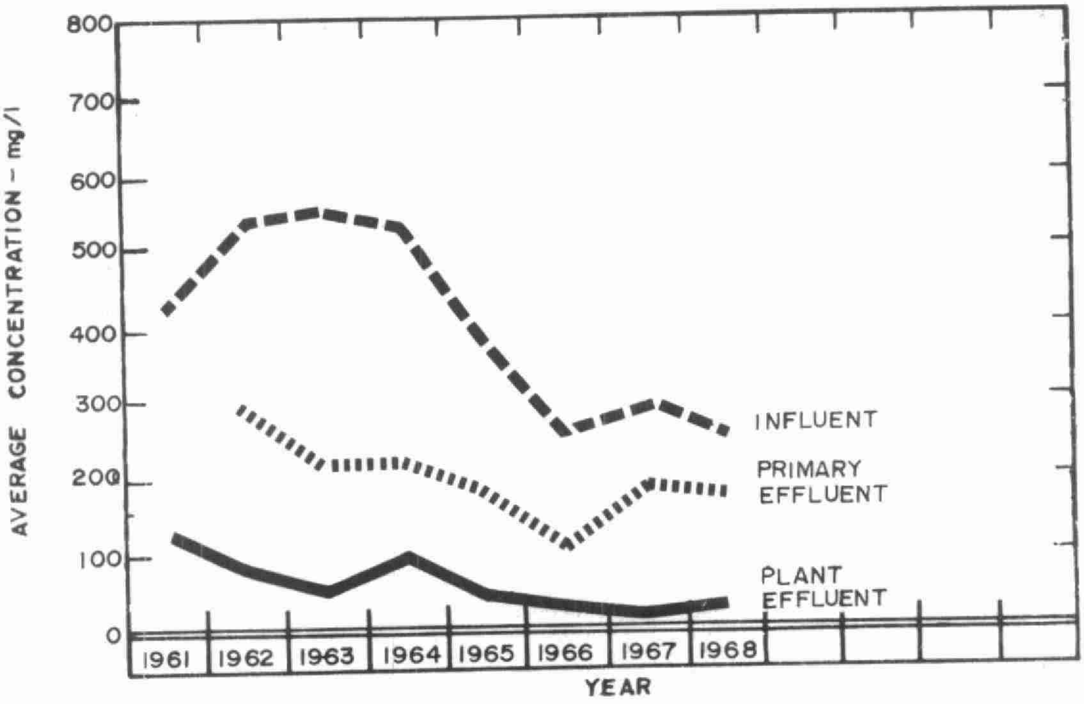


BIOCHEMICAL OXYGEN DEMAND





SUSPENDED SOLIDS



PLANT EFFICIENCY

MONTH	BIOCHEMICAL OXYGEN DEMAND				SUSPENDED SOLIDS				GRIT
	INF CONC^N mg/l	EFF CONC^N mg/l	RED^N %	REMOVAL 10^5 lb	INF CONC^N mg/l	EFF CONC^N mg/l	RED^N %	REMOVAL 10^5 lb	REMOVAL ft^3
JAN	195	19	90	2.01	188	48	74	1.60	62
FEB	370	29	92	4.03	299	37	88	3.09	92
MAR	476	46	90	5.99	289	31	89	3.59	14
APR	334	47	86	3.59	255	62	76	2.42	92
MAY	302	44	85	3.03	242	55	77	2.20	31
JUN	333	20	94	–	290	17	94	–	17
JULY	110	8	93	–	181	15	92	–	200
AUG	380	4	99	–	358	18	95	–	1100
SEPT	–	–	–	–	–	–	–	–	555
OCT	275	29	89	–	243	39	84	–	100
NOV	280	38	86	–	215	42	81	–	300
DEC	275	29	89	–	217	45	79	–	–
TOTAL	–	–	–	–	–	–	–	–	–
AVERAGE	303	28	91	3.73	252	37	85	2.58	233

COMMENTS

The average raw sewage BOD was 303 mg/l, 101 percent of the design value of 300 mg/l. The average plant effluent BOD concentration was 28 mg/l, representing an average BOD reduction of 91 percent.

The average raw sewage suspended solids concentration was 252 mg/l which is 93 percent of the design value of 270 mg/l. The plant effluent suspended solids concentration was 37 mg/l. This represents an average suspended solids reduction of 85 percent.

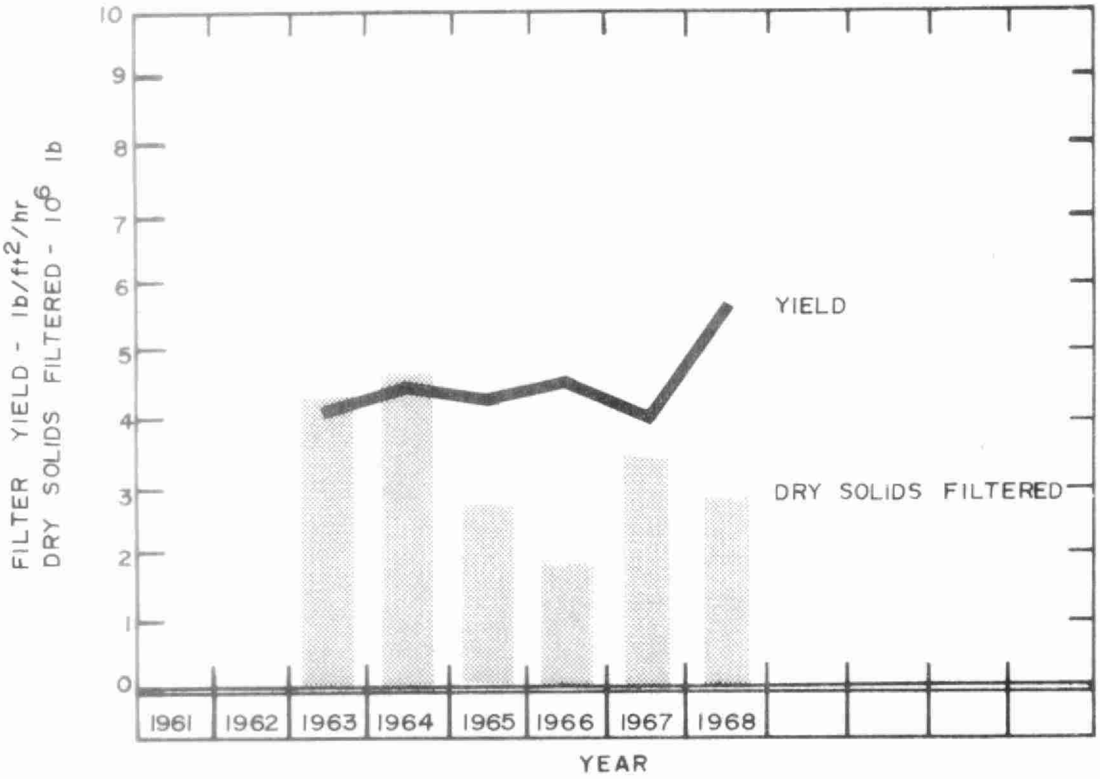
A total of 2563 cubic feet of grit was removed during the year.

AERATION

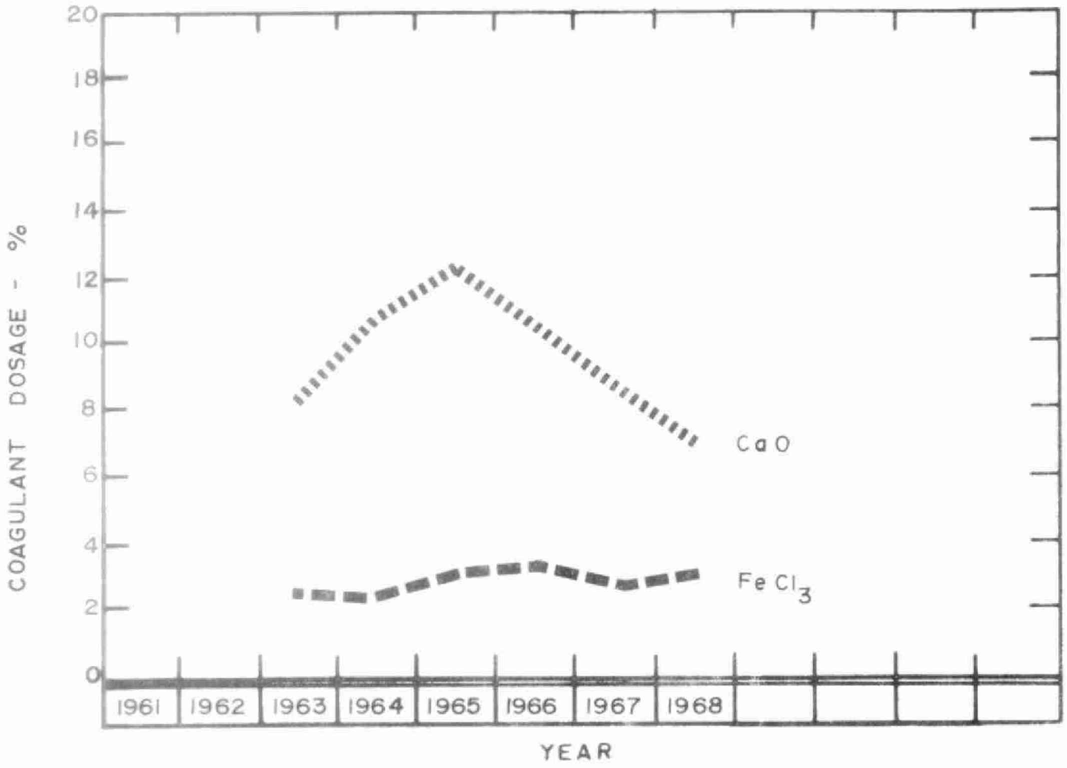
MONTH	AVERAGE FLOW mgd	PRIMARY EFF		SECONDARY EFF		ML SS CONC^N mg/l	F/M $\left(\frac{\text{lb BOD}}{\text{lb MLSS}}\right)$	AIR USED $\left(\frac{\text{1000 ft}^3}{\text{lb BOD}}\right)$ REMOVED	WASTE SLUDGE lb
		BOD CONC^N mg/l	SS CONC^N mg/l	BOD CONC^N mg/l	SS CONC^N mg/l				
JAN	3.68	203	413	19	40	3,010	.17	1.66	–
FEB	4.07	210	213	34	48	2,780	.20	1.57	–
MAR	4.50	263	174	39	23	2,700	.23	1.12	–
APRIL	4.17	315	168	36	39	2,230	.39	.97	–
MAY	3.79	278	201	28	35	3,200	.22	1.18	–
JUN	–	242	131	13	23	2,470	–	–	–
JUL	–	62	79	8	11	2,120	–	–	–
AUG	–	237	99	4	18	940	–	–	–
SEPT	–	–	–	–	–	1,560	–	–	–
OCT	–	198	129	33	33	2,410	–	–	–
NOV	–	180	131	37	51	2,130	–	–	–
DEC	4.21	208	118	26	41	2,330	.25	.73	–
TOTAL	–	–	–	–	–	–	–	–	–
AVERAGE	4.31	218	169	25	33	2,320	.24	1.21	–

COMMENTS

The new primary clarifier was put in operation in August, increasing the total primary clarifier complement to two units. The average primary effluent BOD and suspended solids concentrations using the old clarifier were 250 mg/l and 185 mg/l respectively. The average primary effluent BOD and suspended solids concentrations during the last three months of the year when two clarifiers were in operation were 185 mg/l and 126 mg/l respectively, indicating the more efficient organic removal with two units in operation.



VACUUM FILTRATION



VACUUM FILTRATION

MONTH	TOTAL FILTER USE hr	SLUDGE TO FILTER		CONDITIONING CHEMICALS						FILT. CAKE	* FILTR	YIELD
		CONC	DRY SOLIDS	CaO		FeCl3		POLYMER				lb/ft^2
		T.S. %	10^5 lb	10^3 lb	%	10^3 lb	%	lb	ppm	T.S %	T.S. %	hr
JAN	210	4.7	2.09	21.3	10.2	9.1	4.3	0	–	14.9	0.9	3.3
FEB	248	5.4	3.13	24.3	7.8	9.9	3.2	0	–	16.4	0.9	4.2
MAR	312	5.9	4.73	28.8	6.1	11.5	2.4	0	–	17.5	1.1	5.0
APR	234	5.3	3.09	22.2	7.2	9.7	3.1	0	–	18.1	0.9	4.3
MAY	288	5.4	4.66	29.0	6.2	12.1	2.6	0	–	17.3	1.5	5.2
JUN	160	5.5	3.05	19.3	6.3	5.5	1.8	0	–	17.2	1.2	6.2
JUL	204	4.6	4.22	29.2	6.9	12.7	3.0	0	–	15.8	1.3	6.8
AUG	20	5.9	.54	3.4	6.3	1.1	2.0	0	–	18.3	2.2	8.8
SEP	0	0	0	0	–	0	–	0	–	–	–	–
OCT	113	4.7	2.22	17.1	7.7	7.2	3.3	0	–	14.9	1.0	6.4
NOV	64	5.0	1.32	10.0	7.6	4.3	3.2	0	–	15.9	0.9	6.7
DEC	0	0	0	0	–	0	–	0	–	–	–	–
TOTAL	1853	–	29.05	204.6	–	83.1	–	0	–	–	–	–
AVERAGE	185	5.2	2.42	20.5	7.0	8.3	2.9	–	–	16.6	1.2	5.7

* FILTR. DENOTES FILTRATE PLUS WASH WATER

COMMENTS

During 1968, the filter was operated on an average of 185 hours per month. The vacuum filter reduced the moisture content of the sludge from 94.8 percent to 83.4 percent. The average filter yield of 5.7 pounds per square foot per hour is comparable to other plants filtering raw and waste activated sludge.

The filter was not operated during the months of September and December. Flooding of the filter room basement prevented filter operation in September. The new primary and secondary digesters were placed in operation in December. As a result, sludge was not available for filtration.

SLUDGE DIGESTION and DISPOSAL

MONTH	RAW SLUDGE			DIGESTED SLUDGE			SUPERNATANT		SLUDGE DISPOSAL	
	VOLUME 10^5 gal	T. S. %	V. S. %	VOLUME gal	T. S. %	V. S. %	VOLUME gal	T. S. %	LIQUID yd^3	DEWATERED yd^3
JAN	6.14	5.3	–						1009	767
FEB	8.26	5.3	–						1458	951
MAR	9.54	5.8	–						910	883
APR	7.83	5.3	–						1062	593
MAY	11.30	–	–						1531	857
JUN	8.43	–	–						2348	626
JUL	12.51	4.6	–						1984	898
AUG	10.58	7.0	–						1886	128
SEPT	3.53	8.9	–						2038	0
OCT	7.24	5.4	–						1550	438
NOV	.43	5.1	–						990	290
DEC	–	–	–						–	–
TOTAL	–	–	–						16766	6431
AVERAGE	7.80	5.9	–						1524	643

COMMENTS

Totals of 16,766 liquid cubic yards and 6431 filtered yards of sludge were removed in 1968. More sludge was produced than could be filtered. The excess sludge was removed from the plant in a liquid form.

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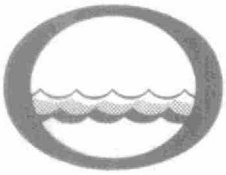
CONCLUSIONS

The design flow of four million gallons per day was exceeded 60 percent of the time, reducing the efficiency of the final clarification units.

This was reflected in average BOD and suspended solids effluents of 28 mg/l and 37 mg/l respectively, and exceeded the OWRC objective of 15 mg/l 87 and 100 percent of the time.

RECOMMENDATIONS

The plant's capacity for final clarification should be increased.



Water management in Ontario